12. (Five times amended) An aluminum alloy consisting essentially of copper, magnesium and lithium in the form of a solid solution, the lithium content being in an amount of from 0.01 to 0.99 wt %, effective to avoid formation of an Al_3Li phase, wherein the alloy comprises clusters of atoms of solute, and wherein the copper and magnesium weight percent values fall within a closed area on a graph with wt % copper on the x-axis and wt % magnesium on the y-axis, said closed area being bounded by generally straight lines joining the following points:

POINT 1 = 3 Cu, 0.6 Mg
POINT 2 = 4.28 Cu, 0.6 Mg
POINT 3 = 3.7 Cu, 2 Mg
POINT 4 = 3 Cu, 2 Mg
and back to POINT 1.

C2

REMARKS

Claims 1-8, 12, 16-22 and 26-37 are pending in the application. Claims 1 and 12 have been amended to delete the fracture toughness recitation.

35 U.S.C. § 112 Rejections

Claims 1-8, 12, 16-22 and 26-37 stand rejected under 35 U.S.C. § 112, first paragraph, as allegedly containing subject matter which was not adequately described in the specification. According to the Office Action, the limitation "a fracture toughness K_{R25} of at least 91.5 ksi$\sqrt{in}$" in Claims 1 and 12 is not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed.

By the present Amendment, the fracture toughness recitation has been removed from Claims 1 and 12, thereby obviating the 35 U.S.C. § 112, first paragraph, rejection.

Claims 30-32 and 35-37 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. According to the Office Action, Claims 30-32 and 35-37 are indefinite because the instant specification fails to provide a standard for

measuring the degree of closeness or proximity of the wording "substantially". Applicants respectfully traverse this rejection.

Claims 30 and 35 recite that the alloy is substantially free of Ag. Claims 1 and 36 recite that the alloy is substantially free of Zn. Claims 32 and 37 recite that the alloy is substantially free of Sc. Basis for these "substantially free" recitations are provided in the specification, for example, at page 4, lines 11-15, wherein the term "substantially free" is defined. Some examples of alloys that are substantially free of Ag, Zn and Sc are provided in the specification at page 9, lines 24 and 25, and page 10, lines 6, 7, 18 and 19.

To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. *Vas-Cath, Inc. v. Mahurkar*, 19 U.S.P.Q.2d 1111, 1116 (Fed. Cir. 1991). The present specification, as noted above, provides sufficient detail of the presently claimed alloys which are substantially free of Ag, Zn or Sc.

Possession may be shown in a variety of ways including description of an actual reduction to practice, or by showing that the invention was "ready for patenting" such as by the disclosure of drawings or structural chemical formulas that show that the invention was complete, or by describing distinguishing identifying characteristics sufficient to show that the applicant was in possession of the claimed invention (emphasis added). *Pfaff v. Wells Electronics, Inc.*, 48 U.S.P.Q.2d 1641, 1647 (1998). The present specification explicitly defines the term "substantially free" and describes the production of alloys (Ingot Nos. 2 and 3) which were substantially free of Ag, Zn and Sc, as recited in the claims.

Ipsis verbis disclosure is not necessary to satisfy the written description requirement of Section 112. Instead, the disclosure need only reasonably convey to persons skilled in the art that the inventor had possession of the subject matter in question. *Fujikawa v. Wattanasin*, 39 U.S.P.Q.2d 1895, 1904 (Fed. Cir. 1996), citing *In re Edwards*, 196 U.S.P.Q 465, 467 (C.C.P.A. 1978). Again, the present specification defines the term "substantially free" and gives examples of alloys that are substantially free of Ag, Zn and Sc.

In *In re Wright*, 9 U.S.P.Q.2d 1649 (Fed. Cir. 1989), the applicant added a negative limitation "not permanently fixed" to the originally filed method claims. The Examiner made a § 112 rejection, arguing that "not permanently fixed" was not supported in the disclosure. The Federal Circuit reversed the Board's affirmation of the Examiner's rejection, stating that the claimed subject matter need not be described *in haec verba* in the specification in order for the specification to satisfy the description requirement.

In *In re Smith and Hubin*, 178 U.S.P.Q. 620 (C.C.P.A. 1973), the applicant filed a continuation-in-part application with claims including the negative limitation "free of alkylatable groups". The specification did not expressly disclose that the final polymer was free of such alkylatable groups. The Court stated that the claimed subject matter need not be described *in haec verba* in the specification in order for the specification to satisfy the description requirement. 178 U.S.P.Q. at 624. Compliance with the first paragraph of § 112 is judged from the perspective of the person skilled in the relevant art, and the specification as originally filed must convey clearly to those skilled in the art that the applicant has invented the specific subject matter later claimed. *Id.* Although the specification did not specifically state "free of alkylatable groups", the Court reviewed the specification as a whole, and found that the recitation of "free of alkylatable groups" had support in the specification. *Id.* The Court therefore found that the specification as a whole conveyed possession of the claimed invention as of the filing date, and that the description requirement of 35 U.S.C. § 112, first paragraph was satisfied. *Id.*

From the foregoing cases, it is well established that language (including negative limitations) may be added to claims without exact word-for-word correspondence in the specification.

As set forth in MPEP § 2163.04, if the applicant amends the claims and points out where and/or how the originally filed disclosure supports the amendment(s), and the Examiner takes the position that the disclosure does not reasonably convey that the inventor had possession of the subject matter of the amendment at the time of the filing of the application, the Examiner has the initial burden of presenting evidence or reasoning to explain why persons skilled in the art would not recognize in the disclosure a description of the invention defined by the claims.

Since the specification fully supports the "substantially free" features recited in Claims 30-32 and 35-37, the rejection of the claims under 35 U.S.C. § 112, first paragraph, should be withdrawn.

35 U.S.C. § 103 Rejections

Claims 1-8, 12, 16-22 and 26-37 stand rejected under 35 U.S.C. § 103 as allegedly be unpatentable over U.S. Patent No. 5,122,339 to Pickens et al. (Claim 1), U.S. Patent No. 5,211,910 to Pickens et al. (abstract), U.S. Patent No. 5,259,897 to Pickens et al. (abstract), WO 9532074 (abstract), WO 9212269 (abstract) or DE 2810932 (abstract). According to the Office Action, the cited references disclose the features substantially as claimed.

The references applied in the Office Action disclose aluminum alloys which include Cu, Mg and Li amounts in widely ranging amounts, but none of the references specifically teach that the combination of Cu, Mg and Li should be controlled within the ranges recited in independent Claims 1 and 12. None of the alloys actually made in accordance with the applied references contained Cu, Mg and Li in the amounts presently claimed. For example, the applied references direct one skilled in the art to use more than the presently claimed maximum amount of 0.99 wt % in order to achieve favorable properties such as increased strength. The relatively low amount of Li recited in the present claims, in combination with the claimed amounts of Cu and Mg, is contrary to the teachings of the applied references.

Moreover, none of the applied references teach or suggest an alloy composition and microstructure wherein Cu, Mg and Li are present in the alloy in the form of a solid solution, and interaction of Li ions in the solid solution gives rise to the formation of clusters of atoms of solute as presently claimed.

Furthermore, it is submitted that the presently claimed alloys possess unexpectedly improved properties in comparison with prior art alloys. Improved mechanical properties achieved by the present alloys are disclosed in the specification. For example, the Table at page 13 of the specification and Figs. 1B, 2 and 4-9 demonstrate unexpectedly improved strengths, fracture toughness and fatigue crack growth resistances achieved by alloys of the present invention (Alloys B, C and D). The

properties disclosed in the application represent unexpectedly improved results which further serve to distinguish over the prior art of record.

U.S. Patent No. 5,122,339 to Pickens et al.

Pickens et al. '339 discloses aluminum-base alloys which may contain 3.5-7 wt % Cu, 0.05-1.5 wt % Mg, 0.01-2 wt % Ag, 0.1-4 wt % Li, and 0.1-2 wt % grain refiner. Although the reference broadly mentions a range of 0.1 to 4 wt % Li, the reference further states that the highest strengths are attained with Li levels of from about 1 to about 1.5 % with decreases below and above these percentages (see column 4, lines 23-25). None of the alloys actually made in accordance with the Pickens et al. '339 reference fall within the presently claimed ranges. For example, the alloys made in accordance with the reference contained from 1.21 to 2.1 wt % Li, well above the maximum of 0.99 wt % Li recited in independent Claims 1 and 12. Reading the Pickens et al. '339 reference as a whole, one skilled in the art would be lead to use greater amounts of Li than presently claimed in order to achieve optimal mechanical properties.

Pickens et al. '339 does not mention Cu, Mg and Li being present in the alloy in the form of a solid solution, and further does not mention interaction of lithium ions in the solid solution giving rise to formation of clusters of atoms of solute, as presently claimed. Instead, Pickens et al. '339 appears to teach away from the presently claimed microstructure by stating that the ultra-high strength of the disclosed alloys may result from the formation of precipitates (T_1 phase (Al_2CuLi)). The alloy microstructure disclosed by Pickens et al. '339 is thus distinct from the presently claimed microstructure in which clusters of atoms of solute are formed.

Furthermore, the Pickens et al. '339 reference does not teach or suggest that the disclosed alloys are capable of attaining the improved fracture toughness achievable by the presently claimed alloys. The improved fracture toughness represents an unexpectedly improved result which further serves to distinguish over Pickens et al. '339.

It is therefore submitted that the Pickens et al. '339 patent, when read as a whole, does not fairly teach or suggest the alloy compositions and microstructure recited in independent Claims 1 and 12.

The dependent claims recite additional features which further serve to distinguish over Pickens et al. '339. For example, dependent Claims 30 and 34 recite that the alloy is substantially free of Ag, while the Pickens et al. '339 reference requires Ag.

<u>U.S. Patent No. 5,211,910 to Pickens et al.</u>

Pickens et al. '910 discloses aluminum-base alloys comprising from about 1 to about 7 wt % Cu, from about 0.1 to about 4 wt % Li, from about 0.01 to about 4 wt % Zn, from about 0.05 to about 3 wt % Mg, from about 0.01 to about 2 wt % Ag, and from about 0.01 to about 2 wt % grain refiners. Although the reference mentions an Li range of from about 0.1 to about 4 wt %, the reference further states that peak strengths fall within the range of from about 1.1 to about 1.4 wt % Li (see column 11, lines 59-64). The alloys actually made in accordance with Pickens et al. '910 contain from 1.25 to 2.4 wt % Li, well above the maximum Li level of 0.99 wt % recited in Claims 1 and 12. When read as a whole, the Pickens et al. '910 reference would lead one skilled in the art to use more Li than presently claimed in order to achieve optimal mechanical properties.

Pickens et al. '910 does not teach or suggest an alloy microstructure as presently claimed including clusters of atoms of solute. Instead, Pickens et al. '910 apparently teaches away from the presently claimed composition and microstructure by stating that Cu concentrations above about 3.0 wt % are useful in order to provide sufficient amounts of Cu to form high volume fractions of T_1 (Al_2CuLi) strengthening precipitates in artificially aged tempers (see column 11, lines 33-40). Pickens et al. '910 further teaches away from the presently claimed microstructure by stating that the use of Mg in the alloys enhances nucleation of strengthening precipitates (see column 2, lines 12-23). The reference does not teach or suggest an alloy composition and microstructure in which Cu, Mg and Li are present in an alloy in the form of a solid solution, and interaction of Li ions in the solid solution gives rise to the formation of clusters of atoms of solute, as presently claimed.

Furthermore, Pickens et al. '910 does not disclose that the alloys are capable of attaining the improved fracture toughness of the presently claimed alloys. The improved fracture toughness represents an unexpectedly improved result, which further serves to distinguish over Pickens et al. '910.

It is therefore submitted that the Pickens et al. '910 patent, when read as a whole, does not fairly teach or suggest the presently claimed invention, as recited in Claims 1 and 12.

The dependent claims recite additional features which further serve to distinguish over Pickens et al. '910. For example, Claims 30 and 34 recite that the alloy is substantially free of Ag, while the Pickens et al. '910 reference requires the presence of Ag. The alloys actually made in accordance with the reference contained from 0.1 to 0.4 wt % Ag. Claims 31 and 35 recite that the alloy is substantially free of Zn, while Pickens et al. '910 requires Zn. The alloys actually made in accordance with the reference include from 0.25 to 2.0 wt % Zn.

U.S. Patent No. 5,259,897 to Pickens et al.

Pickens et al. '897 discloses Al-Cu-Li-Mg alloys. In one embodiment, the reference mentions that the aluminum alloy may contain 3.5-5.0 Cu, 0.8-1.8 Li, 0.25-1.0 Mg and 0.01-1.5 grain refiner. However, the reference further states that the tensile properties of the alloys are highly dependent on Li content, with peak strengths attained with Li concentrations of about 1.1 to 1.3 wt %, with significant decreases below about 1.0 % (see column 20, lines 6-10). The actual alloys made in accordance with the Pickens et al. '897 patent contained either 1.3 wt % Li or 1.7 wt % Li. Reading the Pickens et al. '897 reference as a whole, one skilled in the art would be lead to use greater amounts of Li than presently claimed in order to achieve optimal mechanical properties.

Pickens et al. '897 does not teach or suggest the presently claimed alloy composition and microstructure in which Cu, Mg and Li are present in the alloy in the form of a solid solution, and further does not teach or suggest that interaction of lithium ions in the solid solution gives rise to formation of clusters of atoms of solute, as presently claimed. Instead, Pickens et al. '897 apparently teaches away from the presently recited composition and microstructure by stating that concentrations above about 3.5 wt % Cu are necessary to provide sufficient Cu to form high volume fractions of T_1 (Al_2CuLi) strengthening precipitates in the artificially aged tempers (see column 13, lines 58-62). The reference further states that advantageous properties are obtained when Li content is in the range of 1.0-1.4 wt % and Mg content is in the range of 0.3-0.5 wt %,

showing that the type and extent of strengthening precipitates is critically dependent on the amounts of these two elements (see column 14, lines 48-53). The presently claimed clusters of atoms of solute are distinct from the precipitates disclosed in Pickens et al. '897.

Furthermore, Pickens et al. '897 does not disclose that the alloys are capable of attaining the improved fracture toughness of the presently claimed alloys, which represents an unexpectedly improved result achieved in accordance with the present invention.

It is therefore submitted that the Pickens et al. '897 patent, when read as a whole, does not fairly teach or suggest the presently claimed invention.

WO 9532074 Abstract

The WO 9532074 abstract discloses the addition of scandium to many different types of aluminum alloy compositions. In one embodiment, Sc is added to an Al-Cu-Li-Ag-Mg alloy. According to the abstract, such an aluminum alloy may contain 3.5-5.5 % Cu, 0.40-2.0 % Li, 0.01-0.80 % Ag, 0.01-1.5 % Mg, 0.02-0.5 % Sc and 0-1.0 Zr.

The WO 9532074 abstract does not teach or suggest the presently claimed alloy composition and microstructure in which Cu, Mg and Li are present in the alloy in the form of a solid solution, and further fails to teach or suggest that the interaction of lithium ions in the solid solution gives rise to formation of clusters of atoms of solute, as presently claimed.

The WO 9532074 abstract does not disclose that the alloys are capable of attaining the improved fracture toughness of the presently claimed alloys.

Therefore, the WO 9532074 abstract does not teach or suggest the presently claimed invention.

The dependent claims recite additional features which further serve to distinguish over the WO 9532074 abstract. For example, Claims 30 and 34 recite that the alloy is substantially free of Ag, while the WO 9532074 abstract requires the presence of Ag in the Li-containing alloy. Claims 32 and 37 recite that the alloy is substantially free of Sc, while the WO 9532074 abstract requires the presence of Sc.

WO 9212269 Abstract

The WO 9212269 abstract broadly discloses aluminum alloys containing 0.2-5.0 Li, 0.05-12.0 Zn, 0-5.0 Mg, 6.5 maximum Cu, 1.0 maximum Zr, 2.0 maximum Mn, 2 maximum Ag, 0.5 maximum Fe and 0.5 maximum Si. The abstract further states that the preferred aluminum alloy contains 1.5-3.0 Li (above the presently claimed range), 2.5-2.90 Cu (below the presently claimed range), 0.2-2.5 Mg, 0.2-11.0 Zn, 0.08-0.12 Zr, 0-1.0 Mn and Fe and Si impurities 0.1 % maximum each. The only specific aluminum alloy disclosed in the abstract contained 2.17 Li (well above the presently claimed range), 2.79 Cu (below the presently claimed range), 0.49 Zn, 0.25 Mg, 0.07 Zr, 0.35 Mn and 0.08 V. Based on the WO 9212269 abstract, one skilled in the art would be lead to use more Li than presently claimed, and less Cu.

The WO 9212269 abstract does not teach or suggest the presently claimed alloy composition and microstructure in which Cu, Mg and Li are present in the alloy in the form of a solid solution, and further fails to teach or suggest that the interaction of lithium ions in the solid solution gives rise to formation of clusters of atoms of solute, as presently claimed.

Furthermore, the WO 9212269 abstract does not disclose that the alloy is capable of attaining the improved fracture toughness of the presently claimed alloys.

It is therefore submitted that the WO 9212269 abstract does not teach or suggest the presently claimed invention.

The dependent claims recite additional features which further serve to distinguish over the WO 9212269 abstract. For example, Claims 31 and 35 recite that the alloy is substantially free of Zn, while the WO 9212269 abstract discloses that Zn is a required alloying element.

DE 2810932 Abstract

The DE 2810932 abstract discloses broad ranges of aluminum alloy compositions suitable for resistance welding. The aluminum alloys may contain 2-4 Mg, 0.4-08 Li, 0.1-0.7 Mn, 10.2 maximum Cu, 0.45 maximum Fe, 0.45 maximum Si, 0.4 maximum Cr, 0.1-0.2 Ti, 0.3 maximum Zn, 0.3 maximum Ni, 0.05-0.15 V and 0.15 maximum Zr. The DE 2810932 abstract does not fairly teach or suggest the presently

claimed alloy composition and microstructure. For example, the range of 0 to 10.2% Cu disclosed in the DE 2810932 abstract provides no guidance to one skilled in the art as to the specific amount of Cu that should be used. Undue experimentation would be required. Nowhere does the abstract indicate to one skilled in the art to use from about 3 to about 4.5 wt % Cu, as presently claimed. Furthermore, the abstract directs one skilled in the art to use a relatively high level of Mg (2-4 %) versus the relatively low Mg level presently claimed (from about 0.6 to about 2 wt %).

Furthermore, the DE 2810932 abstract does not teach or suggest that the presently claimed alloy composition and microstructure in which Cu, Mg and Li are present in the alloy in the form of a solid solution, and further does not teach or suggest that interaction of lithium ions in solid solution gives rise to formation of clusters of atoms of solute, as presently claimed. Although the abstract states that the disclosed alloy contains Li in solid solution, the abstract does not teach or suggest that Mg or Cu would be present in the alloy in the form of a solid solution. Instead, at such high Mg levels (2-4 %) and Cu levels (up to 10.2 %), one skilled in the art would not expect such elements to be present in the form of a solid solution.

The DE 2810932 abstract also fails to disclose that the alloys are capable of attaining the improved fracture toughness of the presently claimed alloys.

It is therefore submitted that the DE 2810932 abstract does not fairly teach or suggest the presently claimed invention.

Obviousness-Type Double Patenting Rejection

Claims 1-8, 12, 16-22 and 26-37 stand provisionally rejected under the doctrine of obviousness-type double patenting as being unpatentable over Claims 1-100 of co-pending Application Serial No. 09/591,904. Upon resolution of the other outstanding matters of record, Applicants will evaluate the pending or issued claims of the 09/591,904 application, and will consider filing a terminal disclaimer over the 09/591,904 application or any patent issued therefrom.

Summary

The prior art of record fails to teach or suggest the improved aluminum alloys having compositions and microstructures as recited in independent Claims 1 and 12. It is therefore submitted that Claims 1-8, 12, 16-22 and 26-35 are in condition for allowance. Accordingly, an early notice of allowance of this application is respectfully requested.

In the event that any outstanding matters remain in connection with this application, the Examiner is invited to telephone the undersigned at (412) 263-4340 to discuss such matters.

Respectfully submitted,

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Marked-up Version of Claims

1. (Five times amended) An aluminum alloy consisting essentially of from about 3 to about 4.5 wt % copper, from about 0.6 to about 2 wt % magnesium, and lithium in an amount of from 0.01 to 0.99 wt. %, wherein the copper, magnesium and lithium are present in the aluminum alloy in the form of a solid solution, where interaction of lithium ions in the solid solution gives rise to formation of clusters of atoms of solute providing fatigue resistant alloys[, and wherein the alloy is capable of attaining a fracture toughness KR25 of at least 91.5 ksi√in when the alloy is in a cold worked, naturally aged temper].

12. (Five times amended) An aluminum alloy consisting essentially of copper, magnesium and lithium in the form of a solid solution, the lithium content being in an amount of from 0.01 to 0.99 wt %, effective to avoid formation of an Al_3Li phase, wherein the alloy comprises clusters of atoms of solute [and the alloy is capable of attaining a fracture toughness KR25 of at least 91.5 ksi√in when the alloy is in a cold worked, naturally aged temper], and wherein the copper and magnesium weight percent values fall within a closed area on a graph with wt % copper on the x-axis and wt % magnesium on the y-axis, said closed area being bounded by generally straight lines joining the following points:

POINT 1 = 3 Cu, 0.6 Mg
POINT 2 = 4.28 Cu, 0.6 Mg
POINT 3 = 3.7 Cu, 2 Mg
POINT 4 = 3 Cu, 2 Mg
and back to POINT 1.